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U. S. DEPARTMENT OF AGRICULTURE

Forest Service

APPALACHIAN FOREST EXPERIMENT STATION

Technical Note No. 47

Asheville, N. C.  
May 29, 1941

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PRELIMINARY RESULTS OF EXPERIMENTS IN REFORESTATION OF CUTOVER  
AND BURNED SPRUCE LANDS IN THE SOUTHERN APPALACHIANS

A Progress Report

By

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The original dense forests of red spruce and southern balsam fir, which occupied nearly a million and a half acres in the southern Appalachian mountains, are now nearly gone. They have been clear-cut for lumber and pulpwood, and the reproduction and few remaining seed trees have been largely destroyed by the fires which almost always follow logging operations. Consequently, the spruce type lands are not coming back to spruce or balsam except on areas immediately adjacent (within 225 yards) to the few remaining scattered stands of uncut spruce-fir timber. At present these cutover and fire-scoured areas are either barren or covered with blackberry, ferns, weeds, firecherry, yellow birch or some combination of these species. This condition obviously is neither an economic nor a scenic asset.

The rehabilitation of these high mountain wastelands must be accomplished mostly by artificial regeneration. Some of the more easily planted areas on public lands are now being reforested, but the more difficult sites are being left because suitable planting methods have not yet been developed. This technical note summarizes progress of spruce type regeneration research at the Appalachian Forest Experiment Station.

## Species to Plant

The first planting research of this Station in the cutover spruce-fir type was begun in 1923. Its purpose was to determine what coniferous species were best adapted to these areas. Because of the greatly changed conditions brought about by logging and fire, there was a possibility that some outside species would be more successful than the native trees. A total of 20 species, including the 2 natives, was tested on the slopes of Mt. Mitchell, and after 16 years only 4 species proved adaptable to the climate of the spruce-fir type. They are: southern balsam fir, red spruce, red pine, and Norway spruce. Of these, Norway spruce is the only exotic although red pine is native to the spruce type only in restricted areas in West Virginia. Of the 16 unsuccessful species<sup>1/</sup>, 10 were from North America and 6 from Europe or Asia.

Southern balsam fir is a beautiful, fast growing tree especially adapted for roadside and other scenic planting, although it is not a very desirable timber tree. It is considered the ideal Christmas tree. Red pine is adapted to the drier sites in the spruce type or on slightly lower elevations. Red spruce is usually considered the best species for timber production combined with watershed protection and beauty on all except the drier and more sun-exposed places. Norway spruce is somewhat faster growing than red spruce and can be substituted for it on the moister sites. Because of the drooping limbs at maturity it also makes a beautiful ornamental tree.

## Problem Sites in the Spruce Type

The greatest single obstacle to successful planting in the spruce type is the dense cover of vegetation usually found there. This was confirmed by a study in 1938 of existing plantations. As red spruce and red pine constitute the bulk of past and present planting, the study was confined to these two species. Certain problem sites were discovered where results were so poor that additional research was indicated. These problem sites are described below. The density figure is the estimated proportion of ground shaded by the vegetation.

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<sup>1/</sup>The unsuccessful species were pitch pine, Scotch pine, western white pine, Japanese red pine, lodgepole pine, Japanese black pine, white spruce, Englemann spruce, Sitka spruce, northern white cedar, western white cedar, Douglas fir, European silver fir, white fir, Japanese larch, and European larch.

1. Vegetation chiefly a mat of moss; density 0.8 or more. Such sites are usually poorly drained.
2. Vegetation chiefly ferns or weeds, blackberry vines, and low shrubs between 6 inches and 5 feet tall; density 0.9 or more.
3. Vegetation chiefly firecherry or red maple, sassafras, sumac, rhododendron and yellow birch, more than 5 feet tall; density 0.8 or more.
4. Severe and rocky sites with most of the original humus soil burned away and with insufficient soil pockets for planting at least 400 trees per acre. Vegetation usually less than 0.4 density.

### Results of Experiments

Progress of research on the Monongahela and Pisgah National Forests follows. The four problem sites will be discussed separately and in the order listed above.

1. Because of the relatively small total area involved, no formal research has been done on the poorly drained, moss-covered areas. However, this condition has occurred in small patches on some of the experimental plantings, and later observations may indicate a feasible planting method. Only the small islands or grass hummocks can be successfully planted by methods now in use.

2. Results of experiments on sites occupied by dense herbaceous and shrubby vegetation have shown that increases in first-year survival to desirable levels can be accomplished by the three following treatments:

- a. Release of planted spruce and red pine from competing vegetation during early July of the first season.
- b. Direct seeding in prepared spots 2-1/2 to 3 feet in diameter with seed mulched and screened.
- c. Broadcast burning before planting. This was effective on cover of dense blackberry with a firecherry overstory but not in fern and weed cover.

Treatments no better or even poorer than regular planting technique were: scalps 3 feet in diameter instead of the customary 18 inches, extra large planting stock, use of a complete fertilizer, and treatment of roots with growth hormones.

Release was accomplished by cutting the competing vegetation for a radius of 1-1/2 to 2 feet around each planted tree. This resulted in average first-year survival for all plantations of 96 and 94 percent for red spruce and red pine, respectively. Survival on comparable plantations not released was 76 and 69 percent. Necessity for repeating this operation during subsequent seasons will be determined by further observations.

Direct seeding in prepared spots protected by screens resulted in survivals second only to the release treatment of planted trees. At the end of the first summer, 89 percent of the red spruce and 95 percent of the red pine seed spots had one or more live seedlings. Survival was apparently unaffected by dense vegetation or cover type. The spring examination showed severe frost heaving of both species on the Pisgah plots and of spruce on some of the Monongahela plots. Further observations and study will show whether (1) these seedlings require release, as does planted stock, (2) smaller or unscreened spots will suffice, and (3) a modified and more liberal use of mulch will prevent frost heaving on susceptible areas.

In dense blackberry with a light firecherry overstory, broadcast burning<sup>2/</sup> before planting resulted in first year survival of 83 and 75 percent for red spruce and red pine, respectively, as compared to 66 and 62 percent on unburned checks.

3. Results from experiments in undesirable hardwoods such as firecherry show clearly that in the denser stands, planted red spruce released in early July the first year were vastly superior in survival to trees not released. The summarized results are given in Table 1.

In medium and low density cover, smaller openings of 5 to 7 feet in diameter were nearly as satisfactory as the 10 to 12-foot openings. In high density cover, cutting small openings resulted in a mortality 12 percent greater than cutting large openings.

4. On the severe and rocky sites with shallow soil and sparse

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<sup>2/</sup>General observations in the spruce type have indicated that burning followed by grazing or perhaps even grazing alone will reduce competition on heavily vegetated areas to a point where planting is feasible. This has not, however, been tried experimentally.



Table 1.-Spruce underplanting of undesirable hardwoods.

Total density of cover	Spruce released. Opening 10-12 feet in diameter	Spruce not released
	<u>Percent survival</u>	<u>Percent survival</u>
High	73	27
Medium	89	61
Low	82	74

vegetation, direct seeding of both red spruce and southern balsam fir gave first year success. For the most economical seeding method tested, 83 percent of spruce and 90 percent of fir seed spots were successful at the end of the first summer. Spruce had an average of 4.3, and fir 4.9 seedlings per seed spot. First winter mortality reduced success to 80 and 83 percent, and average number of seedlings per spot to 3.7 and 4.2 for spruce and fir, respectively. Seeding was done on slightly scarified spots about one foot in diameter, 20 viable seeds brushed in lightly with the hand, mulched with dead grass or leaves, and screened.

Several years' additional observations are necessary to determine whether the present promising methods will continue to be superior over others. Experiments are still in progress and more detailed recommendations will be released when available. The economic aspects of planting these problem sites will be explored by comparative cost studies of those methods which assure establishment of forest stands.

